Working with Regulators to Reveal the Value of Distributed Resources

The Regulatory Assistance Project

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Theme of RAP's DER Work

- Reveal the economic value of DER to:
  - Customers
  - Distribution Companies
  - Wholesale Market Participants
  - Regulators

Reveal the Value

- By:
- Getting Cost and Price signals right
- Getting regulatory incentives right - DER value must realizable by the parties that can do something about it.
- Getting market rules/ structure right

RAP Has 3 NRELTasks PLUS

- NREL
  1. Write and publish four papers directed to the regulators
  2. Organize and deliver two regional regulatory workshops .
  3. Organize and participate in national working group on model rule for emission performance standard for DR
- Other Forums
  - NAESO
  - RTO Futures
  - Others

Task 1 - Four Papers

1 Simplified distribution system costing methods

2 Develop system for de-averaged distribution credits for DR customer

3 Case studies for DR and reliability

4 Options to incorporate DR in wholesale markets

Distribution Costs Studies for Distributed Generation

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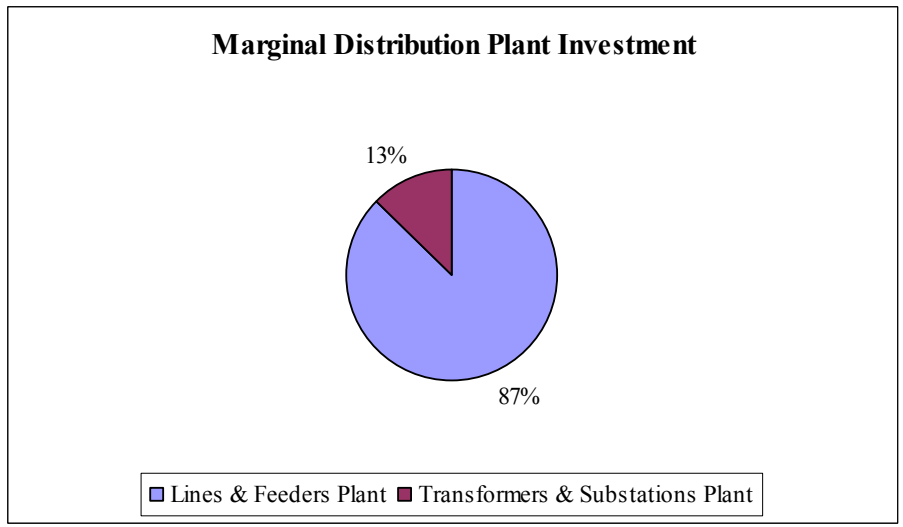
What We Looked At

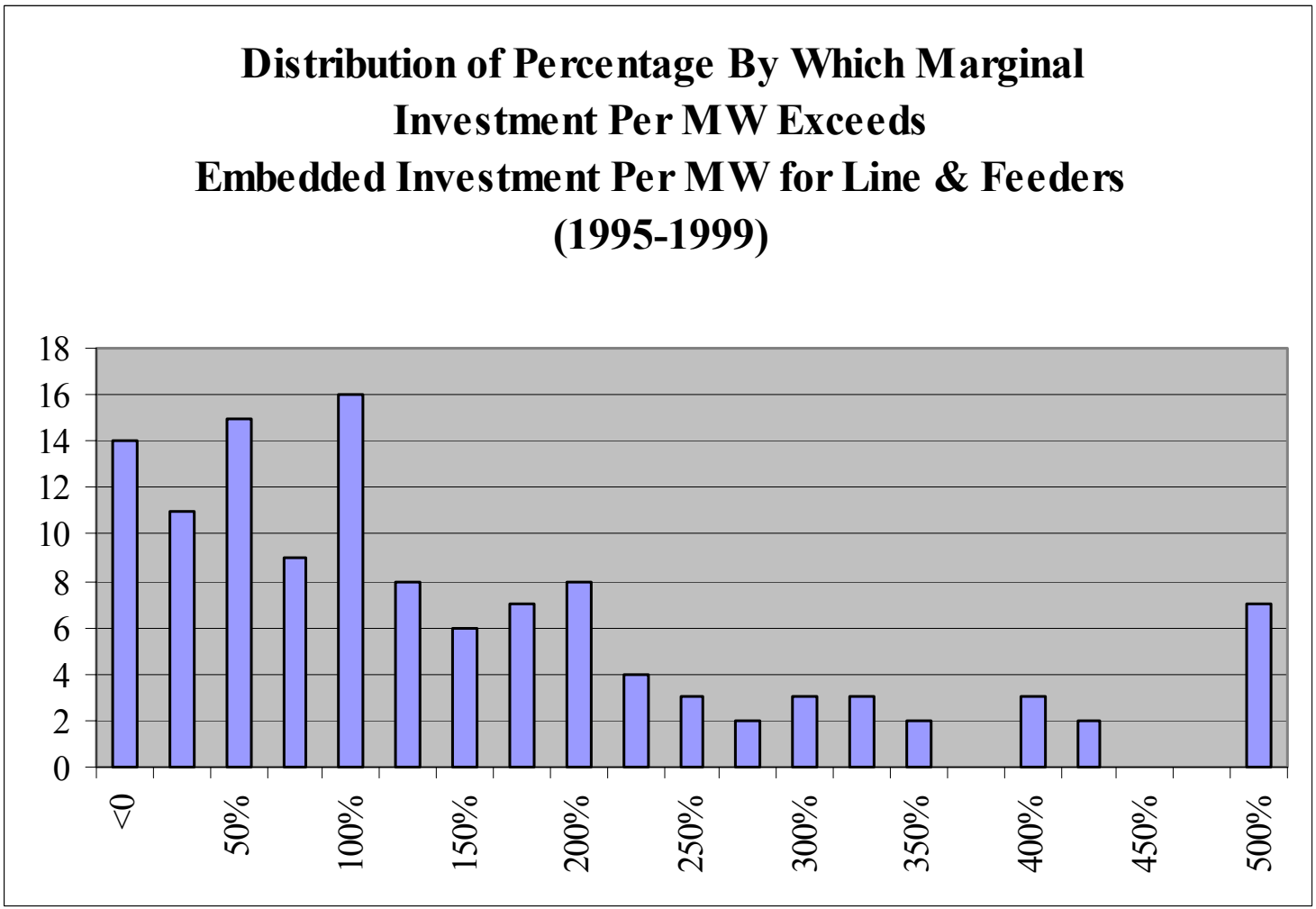
- Distribution Plant
  - Lines & Feeders
    - Plant Invesment
    - O&M
  - Transformers & Substations
    - Plant Investment
    - O&M
- Embedded and Marginal
- FERC Form 1 Database 1994-1999

General Observations

- On Average Marginal Costs Are 135% of Embedded Costs
- Average Annual Investment of 124 Utilities
  - Lines & Feeders -- >$5.6 billion
  - Transformers & Substation -- >$800 million
- Costs Highly Dependent on Geographic Location Within Each Utility



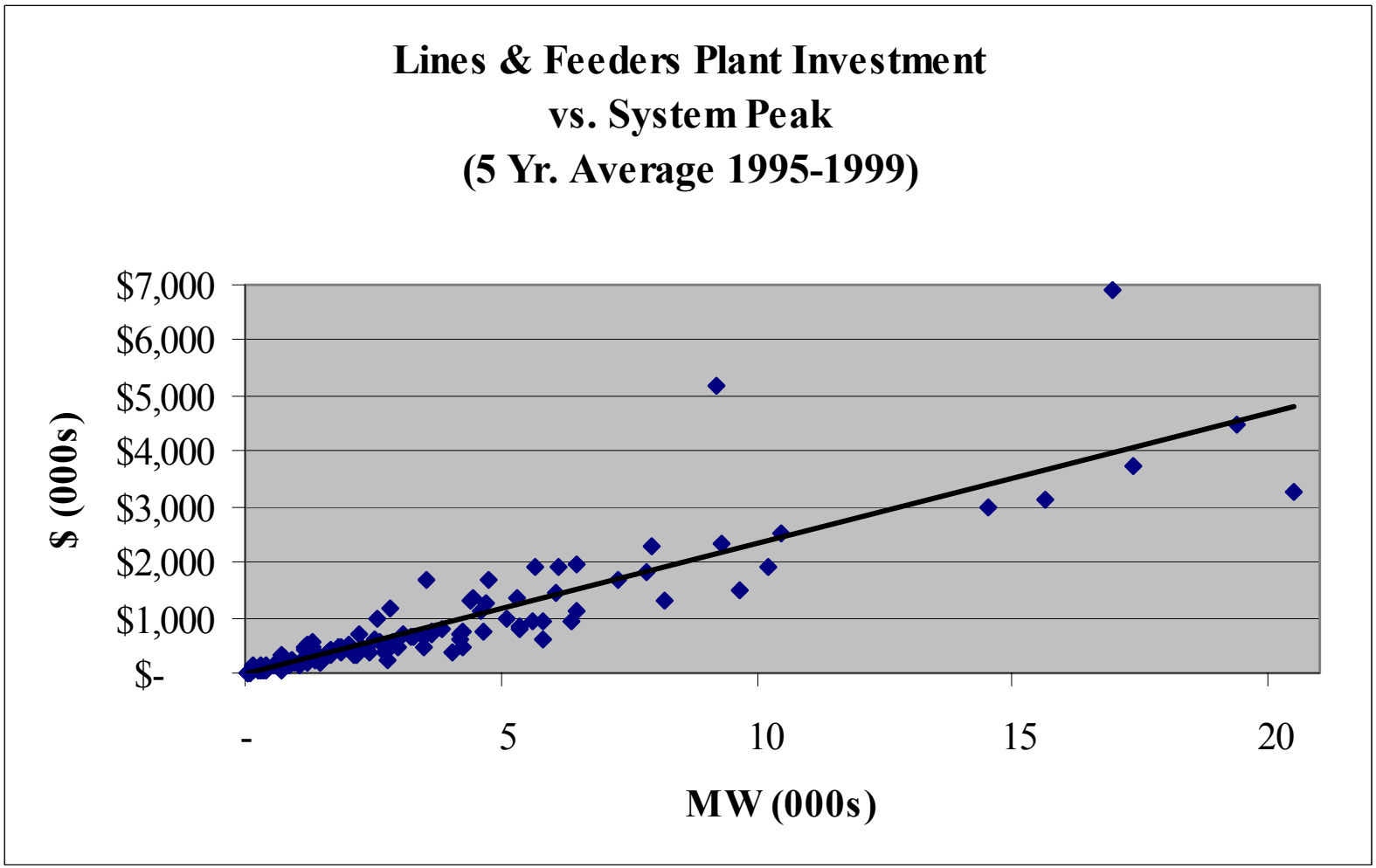
Marginal vs. Embedded Costs



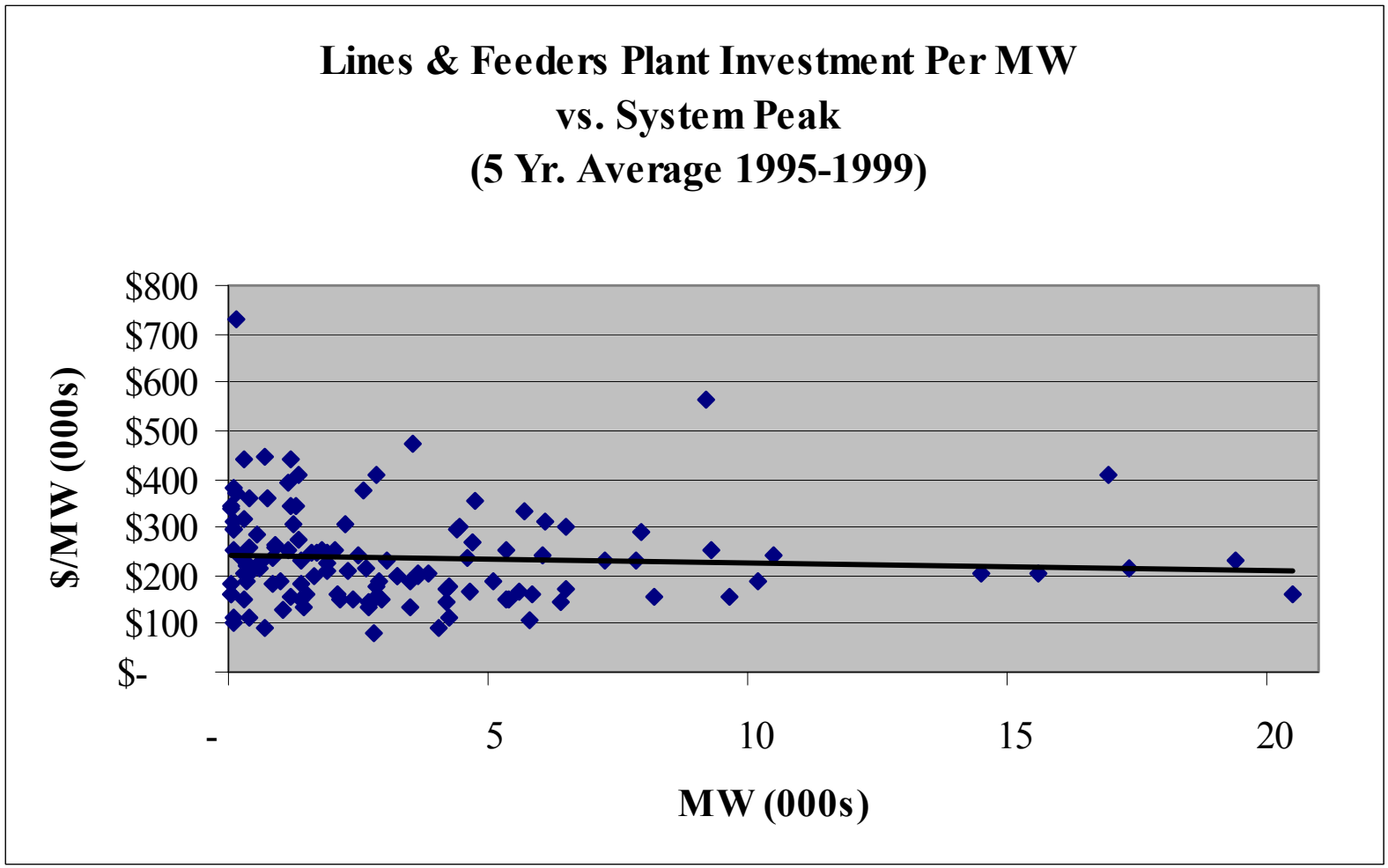
Lines & Feeders Plant Per MW of System Peak

Rank	Company	Lines & Feeders Plant Investment Per System Peak
1	New Hampshire Electric Cooperative, Inc.	$732,359
2	Consolidated Edison Company of New York, Inc.	$561,676
3	San Diego Gas & Electric Company	$473,140
4	Commonwealth Electric Company	$443,330
5	BANGOR HYDRO-ELECTRIC COMPANY	$440,338
	Average	**$237,644**
120	Ohio Power Company	$108,150
121	Lockhart Power Company	$102,673
122	Southwestern Public Service Company	$91,505
123	Northwestern Public Service	$88,950
124	Northern States Power Company (Wisconsin)	$79,787
	Statistical Summary	
	Standard Deviation	$100,906
	Average	$237,644
	Correlation	0.89
	Average Plus Standard Deviation	$338,551
	Average Less Standard Devation	$136,738

Lines & Feeders Plant Per MW of System Peak



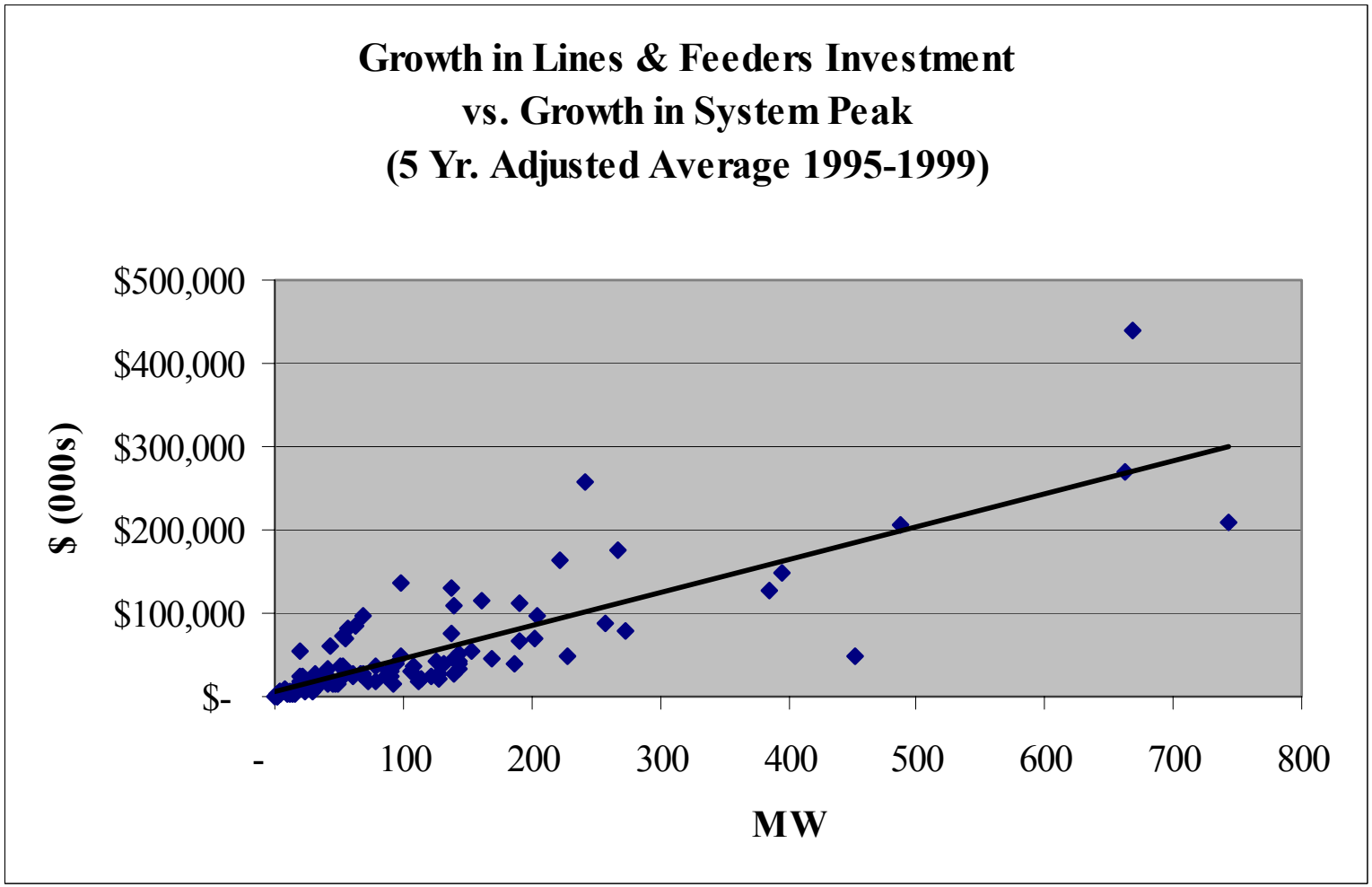
No Economies of Scale for Larger Utilities



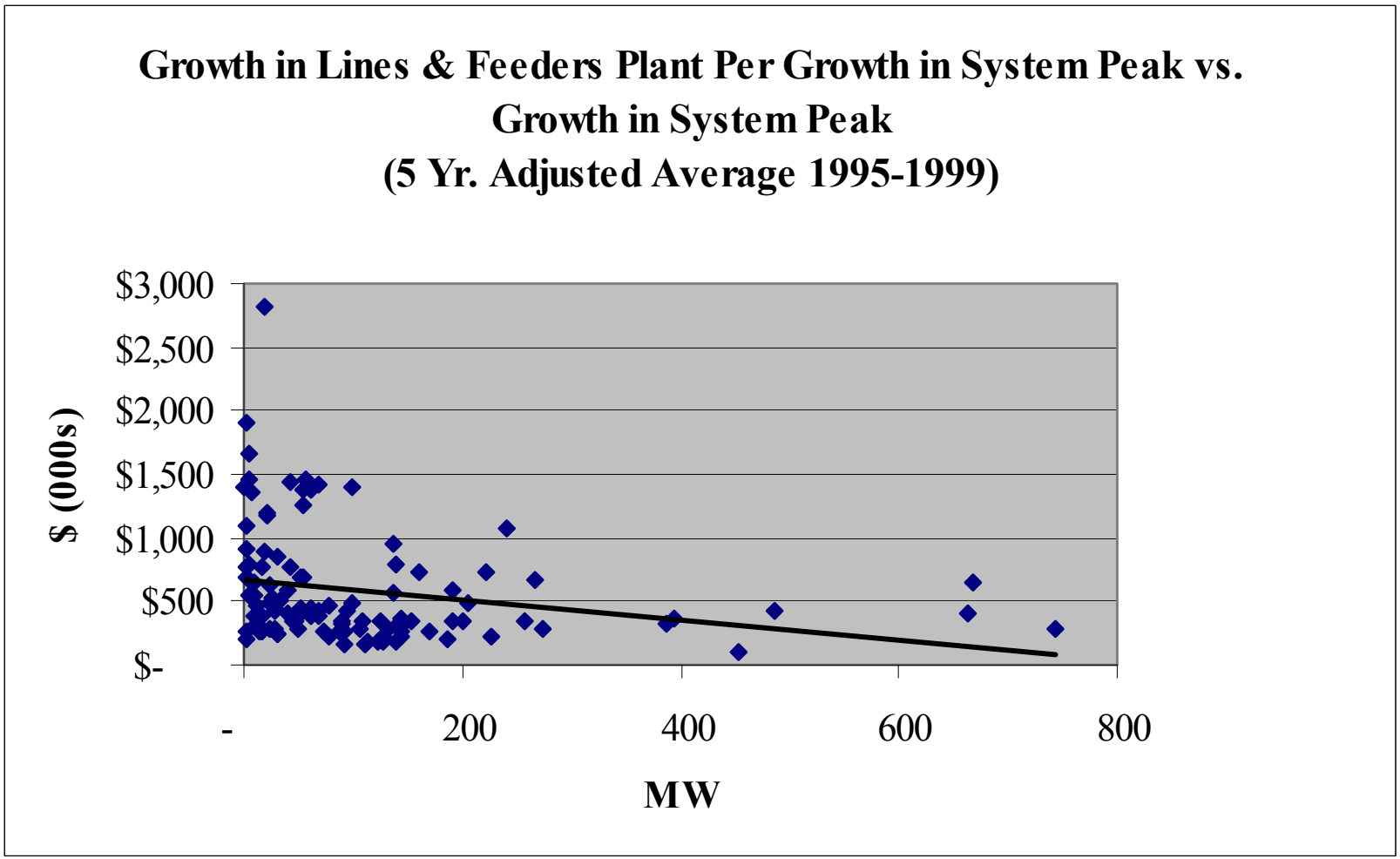
Growth in Lines & Feeders Plant vs. Growth in System Peak

Rank	Company	Growth in Lines & Feeders Plant Investment Per Growth in System Peak
1	THE POTOMAC EDISON COMPANY	$19,483,006
2	New Hampshire Electric Cooperative, Inc.	$7,130,319
3	Central Vermont Public Service Corporation	$6,474,471
4	Pennsylvania Electric Company	$2,815,919
5	Upper Peninsula Power Company	$1,902,999
	Average	**$608,215**
107	Western Resources, Inc.	$184,459
108	Entergy Mississippi, Inc.	$174,603
109	Toledo Edison Company, The	$163,059
110	Kansas Gas and Electric Company	$155,231
111	Entergy Arkansas, Inc.	$108,886
Statistical Summary†		
	Standard Deviation	$447,964
	Average	$589,524
	Correlation	0.83
	Average Plus Standard Deviation	$1,037,488
	Average Less Standard Devation	$141,559

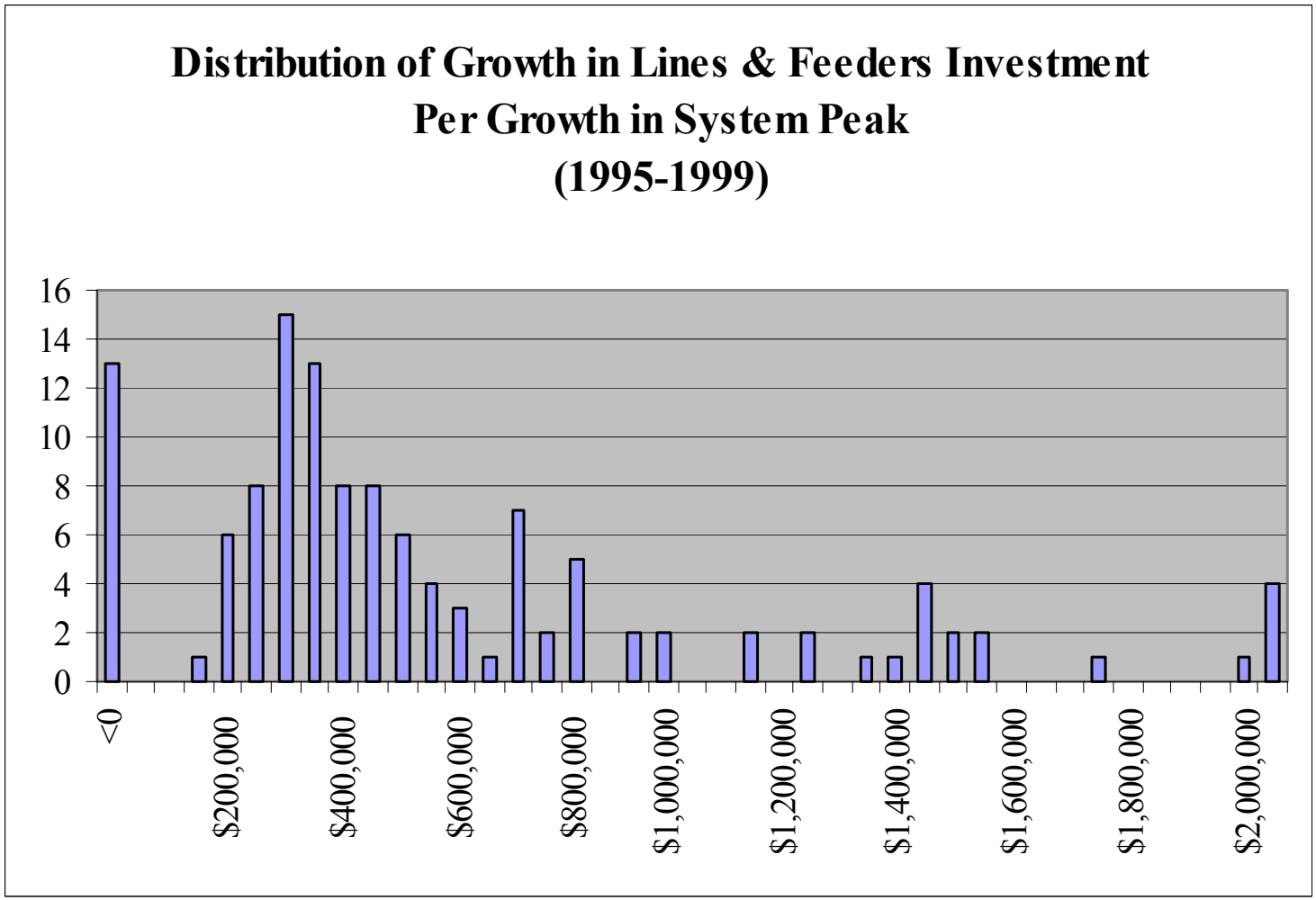
Growth in Lines & Feeders Plant vs. Growth in System Peak



No Economies of Scale For Faster Growing Utilities



Distribution of Marginal Costs: Lines & Feeders Per MW



An Eastern High Cost Utility: PP&L

Value of Project Deferring DR ($/kW)

Company PP&L, Inc.

Marginal $/MW	Trans. & Subst.		Lines & Feeders	
	$52,816	$389,084	$91,788	$2,823,156
Deferral Years	Case		Case	
	Low	High	Low	High
1	$ 6.40	$ 47.16	$ 11.13	$ 342.20
5	$ 26.42	$ 194.62	$ 45.92	$ 1,412.15
10	$ 40.84	$ 300.89	$ 70.99	$ 2,183.21
15	$ 48.45	$ 356.93	$ 84.21	$ 2,589.84
25	$ 54.23	$ 399.50	$ 94.26	$ 2,898.71
30	$ 55.08	$ 405.77	$ 95.74	$ 2,944.26

A Eastern Low Cost Utility: Atlantic City Electric Company

Value of Project Deferring DR ($/kW)

Company **Atlantic City Electric Company**

Marginal $/MW	Trans. & Subst.		Lines & Feeders	
	$7,861	$57,908	$16,659	$512,372
Deferral Years	**Case**		**Case**	
	Low	**High**	**Low**	**High**
1	$ 0.95	$ 7.02	$ 2.02	$ 62.11
5	$ 3.93	$ 28.97	$ 8.34	$ 256.30
10	$ 6.08	$ 44.78	$ 12.90	$ 396.25
15	$ 7.22	$ 53.13	$ 15.31	$ 470.05
25	$ 8.08	$ 59.46	$ 17.14	$ 526.12
30	$ 8.20	$ 60.40	$ 17.41	$ 534.38

Summary

- High Variability of Costs Among Utilities
- High Variability of Costs Within Utilities
- Most New Investment is in Lines & Feeders
- Significant Dollars At Stake
  - For 124 Utilities over $6.4 Billion Invested Per Year
  - Equals Approximately $1.2 Billion in Revenue Requirements *Increase* Per Year
- Significant Opportunities for DR Options

Distributed Resource Distribution Credits

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Distribution Costs

- Distribution costs vary greatly
  - Marginal costs range from 0 to 20 cents per kWh
- High cost areas can be urban or rural
- Approximately 5% of a distribution system is "high cost" at any time

Pricing

- Geographically deaveraging prices is probably not the answer
- Prices would range from 0 to 20 cents per kWh
- Neighbors would see widely different prices
- equity and other customer acceptance issues would be large

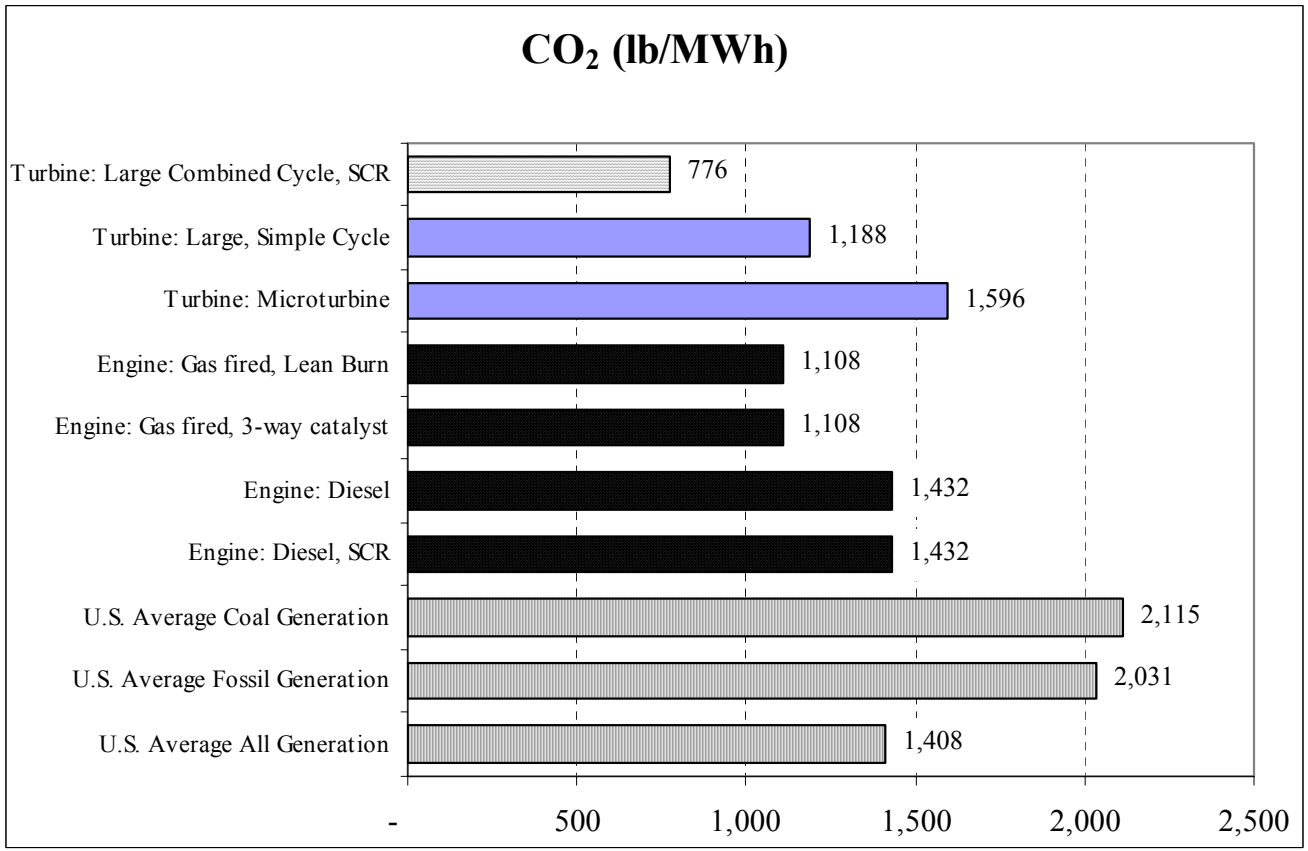
Distribution Credits

- Offering distribution credits can send the same price signals with much less risk
- Credits can focus on customer and vendor actions
- Credits can be limited to "qualifying DR"
- Can use standard payments and/or bidding

Qualifying DR

- Types
- Operating and performance standards
- Installation time and milestones
- Min/Max amounts
- Duration

Emissions Comparison



Demand Response, Distributed Resources, and Reliability

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Demand Response Contributes

- Make Markets Work
- Efficient Use of Capital
- Reduce Costs
- Reduce Market Volatility
- Reduce Emissions (Sometimes)
- Provide System Operator Options
- BIG FACTOR IN **RELIABILITY**

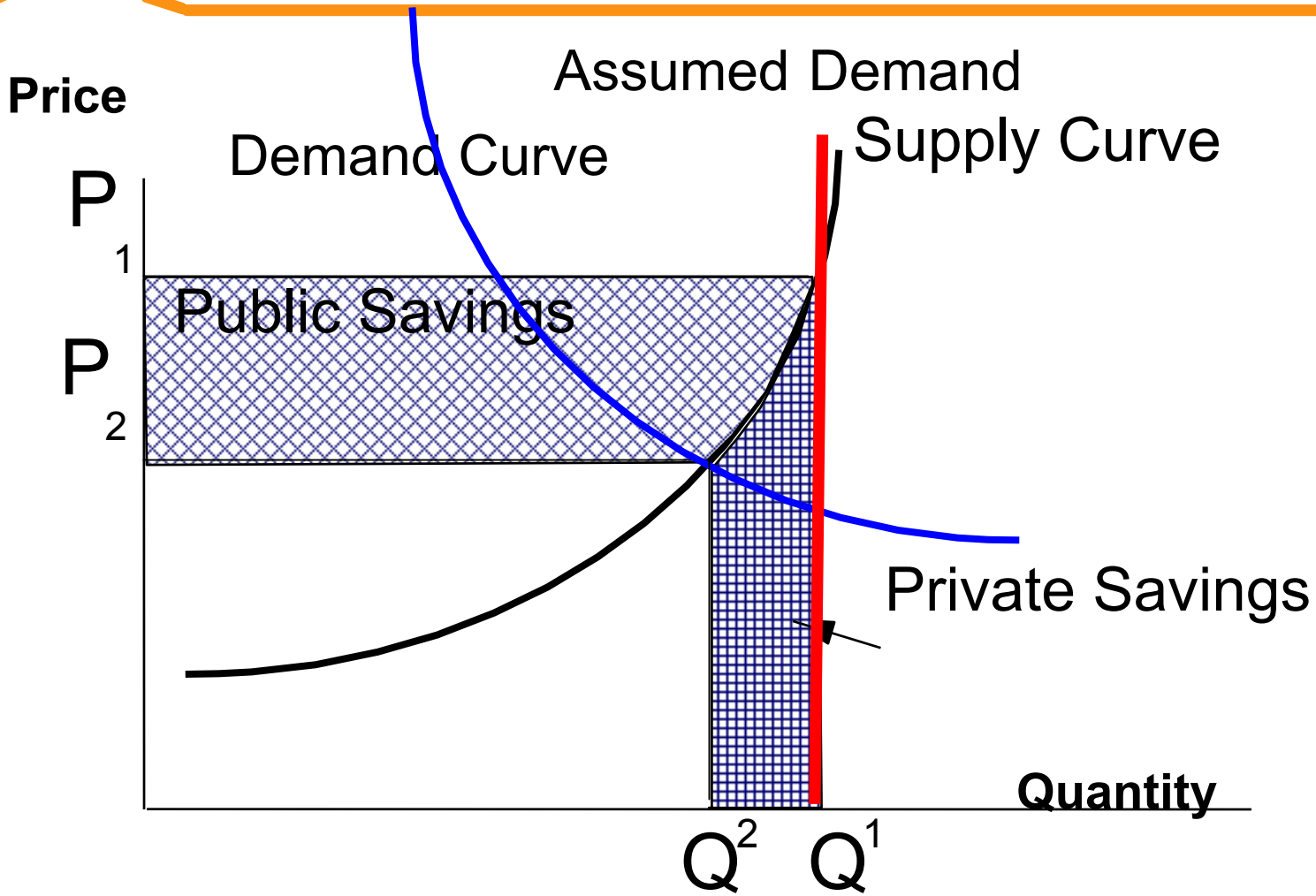
How Demand Response Works

- Traditional Approaches
  - time of use rates, seasonal pricing
  - isolate from the grid with local gen.
- Real-time Market Approaches
  - programmed appliances
  - Internet-based bidding
- Reveals The Real Electricity Demand Curve

Modest Participation Big Impact

- EPRI: 10% participation of demand response would have reduced peak prices 33 - 66% in Midwest in 1998.
- NYMEX: 5% would have reduced prices 80-90%
- EPRI: In California in 2000, 1% reduction in load >> 10% reduction in peak prices, 5% reduces peak prices 19%

Demand Response Saves Everyone Money



Efficient Reliability Menu

- Demand Side Bidding
- Multi-settlement Markets
- Ancillary Svcs in Demand Market
- Efficient Reliability Standard
- Poolwide Uplift Charges for Efficient Technologies

Efficient Reliability Standard

Before "socializing" costs of a proposed reliability-enhancing investment through tariff, uplift, or other cost-sharing requirement, FERC, the state PUC, and the relevant RTO should first require a finding:

(1) that the relevant market is fully open to demand-side as well as supply-side resources;

(2) that the proposed investment or standard is the lowest cost reasonably-available means to correct a remaining market failu

(3) that benefits from the investment or standard will be widespread, and thus appropriate for support through broad-based funding.

Distributed Resources Emissions Collaborative

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Purpose

- Recognize the role of DR in existing and restructured electricity markets
- Collaborate to develop model emissions standards for distributed generation

Purpose

- What concerns are being addressed?
  - Environmental protection with technology and industry changes
  - Promoting clean DR
    - Also, renewables and energy efficiency
  - Administrative simplicity
  - Promoting certification of small engines at clean standards

DG Challenges

- Establish a technology-neutral, technology-forcing emissions standard
  - Output-based emissions standards (lbs/MWh)
- Monitor increased use of back-up generators
- Coordinate air regulations
- Establish standards for small sources
- Factor in positive externalities, e.g., CHP

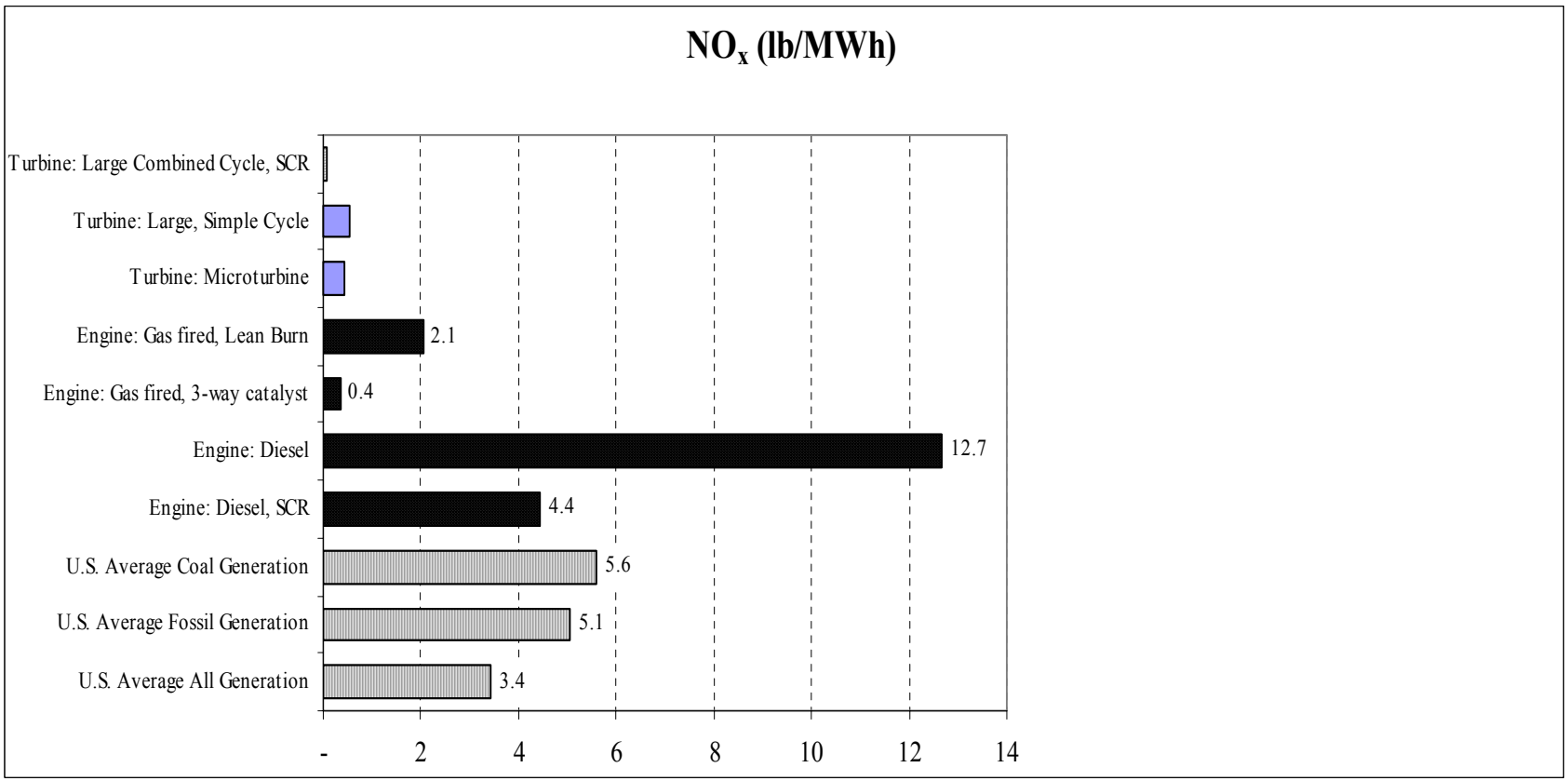
Principles

- The model emissions standards should:
  - Lead to improved air quality, or at least do no additional harm
  - Be technology-neutral and fuel-neutral, to the extent possible
    - Develop output-based emissions standards
    - Address issues surrounding existing vs. new DR

Principles

- The model emissions standards should:
  - Promote technological improvements in efficiency and emissions output
    - Encourage the use of non-emitting resources
      - e.g., wind, PV, direct conversion fuel cells
    - Account for the benefits of CHP and the use of otherwise flared gases
  - Be easy to administer
    - Facilitate the development, siting, and efficient use of DR

Emissions Comparison



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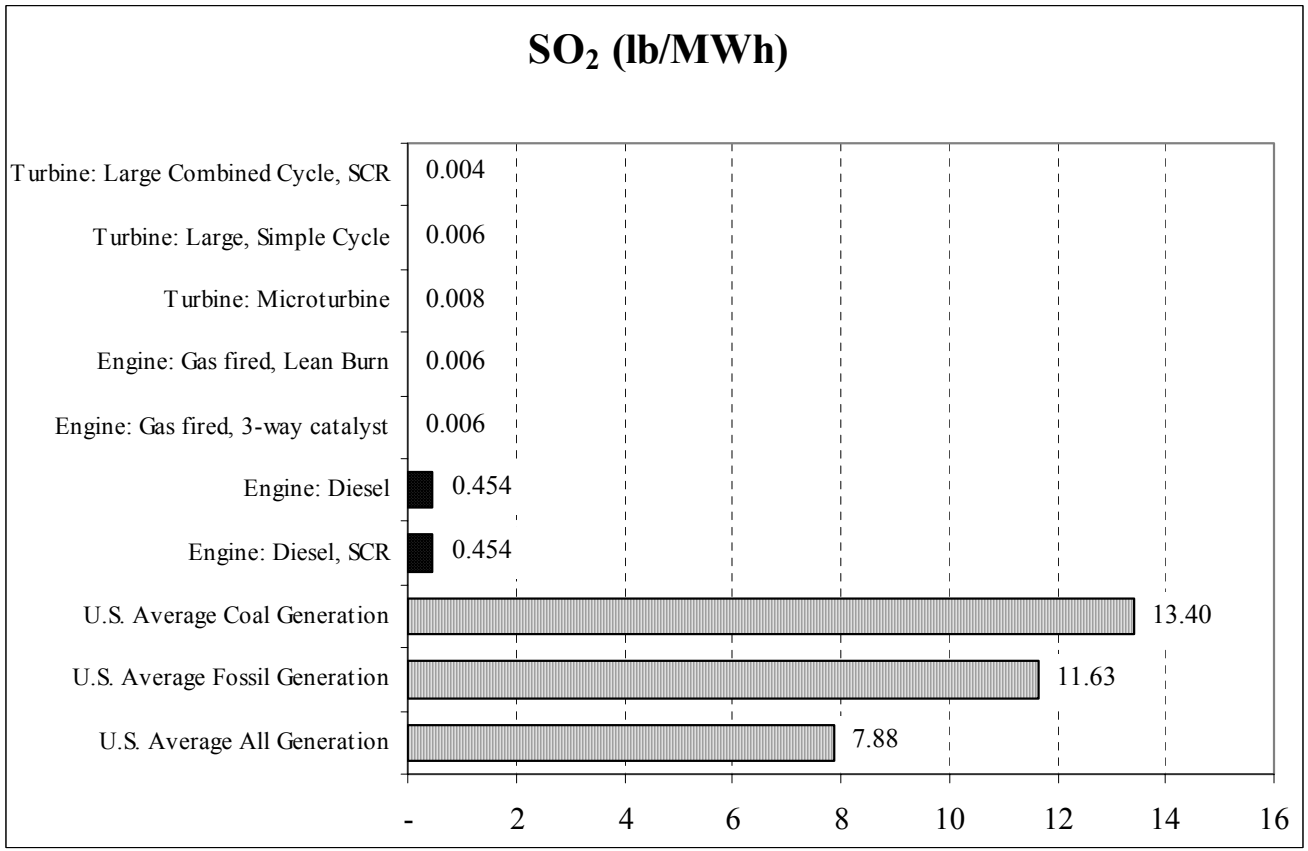

Applicability

- What type of sources should be covered?
- What size engines should be addressed? (not covered by NSR or state BACT)
  - limit by tons, kW, hours of operation?
  - Less than 1 MW, 500 kW, 200 kW, 50 kW?
- What functions should be covered? (general use, emergency, limited)

Applicability

- Establish “appropriate” emissions standards
  - Better than grid average, as good as new BACT for large combined cycle sources?

Current Directions

- Differentiation by:
  - Hours of operation (emergency, peak, baseload)
  - Attainment, non-attainment
  - Implementation date -- a “glide path” over time to enable manufacturers to improve products
- First draft by the end of the summer
  - Disseminated broadly for public comment

Conclusions

- Significant Dollars At Stake
  - For 124 Utilities over $6.4 Billion Invested Per Year
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- Significant Opportunities for DR Options